CLAIMS:

1. A homogeneous catalyst for the production of methanol from purified synthesis gas at low temperature and low pressure which comprises a transition metal capable of forming a transition metal complex with coordinating ligands, and an alkoxide, said catalyst dissolved in a methanol solvent system, provided said transition metal complex is not transition metal carbonyl.

2. The homogenous catalyst of claim 1, wherein said coordinating ligands are selected from the group consisting of N-donor ligands, P-donor ligands, O-donor ligands, C-containing ligands, halogens and mixtures thereof.

3. The homogenous catalyst of claim 1, wherein the catalyst components are completely dissolved in the methanol solvent system to yield a homogeneous liquid solution.

4. The homogenous catalyst of claim 1, wherein said synthesis gas comprises CO_2, CO, or H_2.

5. The homogenous catalyst of claim 1, wherein said transition metal is a metal from Group 6, Group 8, Group 9, Group 10, Group 11, Group 12 or mixtures thereof.

6. The homogenous catalyst of claim 1, wherein said transition metal is Cr, Mo, W, Fe, Ru, Os, Co, Rh, Ir, Ni, Pd, Pt, Cu, Au, Zn, Cd, or mixtures thereof.

7. The homogenous catalyst of claim 1, wherein said transition metal is selected from the group consisting of Ni, Pd, Mo, Cu, Ru, Fe and mixtures thereof.

8. The homogenous catalyst of claim 1, wherein said ligands are selected from the group consisting of chloride, acetylacetonate, 2, 2-dipyridyl, bis (cyclooctadiene), 1, 10-phenanthroline, 1, 2-bis (diphenylphosphinoethane) and mixtures thereof.

9. The homogenous catalyst of claim 1, wherein said metal alkoxide comprises a metal selected from alkali metals or alkaline earth metals.

10. The homogenous catalyst of claim 1, wherein said metal alkoxide is derived from C_{1-6} alcohols, C_{2-20} glycols, C_{2-20} monoglycol ethers.

11. The homogenous catalyst of claim 1, wherein said metal of said metal alkoxide is potassium or sodium.

12. The homogenous catalyst of claim 1, wherein said metal alkoxide is potassium methoxide or sodium methoxide.

13. The homogenous catalyst of claim 1, wherein said methanol solvent system is methanol.

14. The homogenous catalyst of claim 13, wherein said methanol solvent system further comprise a co-solvent selected from the group consisting of glymes, glycols, monoglycol ethers, amino solvents, other oxygenated solvents and mixtures thereof.

15. The homogenous catalyst of claim 14, wherein said co-solvent is selected from the group consisting of triglyme, tetrahydrofuran, dioxane, polyethylene glycol, derivatives of polyethylene glycol and mixtures thereof.

16. The homogenous catalyst of claim 1, further comprising a co-catalyst, said catalyst being a metal selected from metals from the group consisting of Group 6, Group 7, Group 8, Group 9 and mixtures thereof.

17. The homogenous catalyst of claim 16, wherein said co-catalyst is a metal selected from the group consisting of Cr, Mo, W, Co, Ni, Fe, Cu, Ru, Rh, Pd, Pt and mixtures thereof.

18. A homogenous catalyst system comprising the catalyst of claim 1 and a support therefor.

19. The homogenous catalyst system of claim 18, wherein said support is selected from the group consisting of zeolites, clays, acidic zeolites, alumina, silica and mixtures thereof.

20. A homogenous catalyst for the production of methanol from synthesis gas at low temperature and low pressure, said catalyst produced by reacting a transition metal complex having coordinating ligands selected from the group consisting of N-donor ligands, P-donor ligands, O-donor ligands, C- donor ligands, halogens and mixtures thereof or precursors thereof with an alkoxide in a methanol solvent system over a temperature range and pressure range over a period of time effective to form said catalyst, provided at least one C-donor ligand is not carbonyl.

21. The homogenous catalyst of claim 20, wherein said temperature range is from about room temperature to about 150°C and said pressure range is from about 1500 psig to about 70 psig.

22. The homogenous catalyst of claim 21, wherein said period of time ranges from about 1 min in to about 30 min.

23. A method of producing methanol from purified synthesis gas, said method comprising contacting said synthesis gas with a homogenous catalyst dissolved in a methanol solvent system at low temperature and low pressure, said catalyst including a transition metal complex with coordinating ligands provided said complex is not transition metal carbonyl.

24. The method of claim 23, wherein said coordinating ligands are selected from the group consisting of N-donor ligands, P-donor ligands, O-donor ligands, C-donor ligands, halogens and mixtures thereof.

25. The method of claim 23, wherein said synthesis gas further comprises CO_2, CO or H_2.

26. The method of claim 23, wherein said transition metal is a metal from Group 6, Group 8, Group 9, Group 10, Group 11, Group 12 or mixtures thereof.

27. The method of claim 23, wherein said transition metal is selected from the group consisting of Cr, Mo, W, Fe, Ru, Os, Co, Rh, Ir, Ni, Pd, Pt, Cu, Au, Zn, Cd, and mixtures thereof.

28. The method of claim 23, wherein said ligands are selected from the group consisting of chloride, acetylacetonate, 2, 2-dipyridyl, bis (cyclooctadiene), 1, 10-phenanthroline, 1, 2-bis (diphenylphosphinoethane) and mixtures thereof.

29. The method of claim 23, wherein said temperature is from about room temperature to about 150°C and said pressure is from about 70 psig to about 1500 psig.

30. The method of claim 23, wherein said alkoxide is a methoxide selected from the group consisting of potassium methoxide, sodium methoxide and mixtures thereof.

31. The method of claim 23, wherein said methanol solvent system is methanol or methanol and a co-solvent, said co-solvent selected from the groups consisting of tetrahydrofuran, p-dioxane, polyethylene glycol and derivatives of polyethylene glycol and mixtures thereof.

32. The method of claim 23, wherein said homogenous catalyst comprises a co-catalyst metal selected from metals of the groups consisting of Group 6, Group 7, Group 8, Group 9 and mixtures thereof.

33. The method of claim 30, wherein said co-catalyst is a metal selected from the group consisting of Cr, Mo, W, Co, Ni, Fe, Cu, Ru, Rh, Pd, Pt and mixtures thereof.

34. A method for decomposition of a metal alkyl carbonate to carbon dioxide and the precursor metal alkoxide comprising contacting said metal alkyl carbonate with a homogenous metal carbonyl catalyst dissolved in a methanol solvent system, wherein the metal of said metal carbonyl catalyst is selected from metals of the groups consisting of Group 6, Group 7, Group 8, Group 9 and mixtures thereof.

35. The method of claim 34, wherein the metal of said metal alkoxide is an alkali metal or an alkali earth metal.

36. The method of claim 34, wherein said metal alkoxide is potassium methoxide, sodium methoxide or mixtures thereof.

37. The method of claim 34, wherein said metal alkoxide is derived from C_{1-6} alcohols, C_{2-20} glycols, C_{2-20} monoglycol ethers.

38. The method of claim 34, wherein the metal of the metal carbonyl is selected from the group consisting of Cr, Mo, W, Co, Ni, Fe, Cu, Ru, Rh, Pd, Pt and mixtures thereof.

39. The method of claim 34, wherein said methanol solvent system is methanol.

40. The method of claim 39, wherein said methanol solvent system further comprises a co-solvent selected from triglyme, tetrahydrofuran, dioxane, polyethylene glycol, derivatives of polyethylene glycol or mixtures thereof.

41. The method of claim 34, wherein the temperature is from about room temperature to less than about 150°C and the pressure is from about 70 psig to less than 1500 psig.